REMARKS

Claims 1-33 are all the claims pending in the application.

The Drawings are objected to because a descriptive title and labels for the two axels for axes for Figure 5 are missing.

The Specification in the title of the invention is objected to for not being descriptive and because of other minor informalities.

Objection to the Drawings

The Examiner objected to the drawings because the axes in Fig. 5 are not labeled (see page 2 of the Office Action). Fig. 5 has been amended to remedy this informality. A Marked Up Drawing Sheet labeling the axes with an x and y is enclosed. Applicant respectfully requests that the Examiner acknowledge receipt and indicate approval of the drawing correction in the next Patent Office paper.

Objection to the Specification and the Claims

The Examiner objected to the specification alleging that the title of the invention is not descriptive and because of other minor informalities (pages 2-3 of the Office Action). Applicant thanks the Examiner for pointing out, with particularity, the aspects of the claims and the specification containing the minor informalities. Applicant respectfully requests that the Examiner withdraw these objections in view of the self-explanatory amendments being made herein to the specification and the claims.

Turning to the merits of the Office Action, the Examiner rejected claims 1 and 2 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,463,432 to Murakawa (hereinafter "Murakawa") and claims 3-12, 14-19, 23-25, 29-31 under 35 U.S.C. § 103(a) as being obvious

over various combinations of Murakawa and ***nine secondary references***, *i.e.*, U.S. Patent No. 6,519 ,360 to Tanaka (hereinafter "Tanaka"), U.S. Patent No. 6,693,962 to Murching et al. (hereinafter "Murching"), "Peer Group Filtering and Perceptual Color Image Quantization" by Deng et al. (hereinafter "Deng-PFG"), "Color Image Segmentation" by Deng et al. (hereinafter "Deng-CIS"), U.S. Patent No. 6,801 ,657 to Cieplinski (hereinafter "Cieplinski"), "Texture Features and Learning Similarity" by Ma et al. (hereinafter "Ma"), U.S. Patent No. 5,999,647 to Nakao (hereinafter "Nakao"), U.S. Patent No. 6,131,082 to Hargrave III et al. (hereinafter "Hargrave"), and U.S. Patent No. 5,083,571 to Prichep (hereinafter "Prichep").

In general, the present invention is related to retrieving images based on a combination of color and texture features of the image. In the conventional image retrieval methods, color and texture based data retrievals are <u>separately carried out</u>, and color and texture features are <u>extracted from the entire image</u>; consequently, there is a problem that the conventional methods <u>cannot be applied to an image having a plurality of objects</u> therein or expressed in multiple colors and textures.

Another conventional image retrieval method retrieves a target image in the vector space formed for both color and texture vector components. In this related art method, the vector space is formed through simple summations of the color and texture vector components, thereby increasing dimensionality of the vector space. Thus, in this related art technique, there is a need to redefine a distance function to the vector space with the increased dimensionality and to calculate a weighting factor for each component, which is relatively burdensome. These computations are highly complex and the results may be incorrect.

In an aspect of the present invention, however, data images similar to a query image can be retrieved based on the human visual perception mechanism by combining both color and texture features extracted from image regions. In particular, this image region based retrieval method enables accurate retrieval of many objects and many kinds of information from a single image. The distribution of lower-level features, color, and texture, in the 2-D vector spaces is projected onto a 1-D distance space, and thus higher-level features can be effectively expressed with a small number of weighting factors and reduced vector computations.

Turning to the cited references, Murakawa teaches an apparatus and a method of similar-image retrieval system (see *Abstract*). In particular, Murakawa discloses specifying a key image by the user operating an input unit to give a key-image specifying instruction. Next, the feature values of the specified key image are loaded, and weighting factors for the feature values are calculated from the feature values of the key image. For this calculation, the weighting-factor calculation unit receives feature values of the key image from the data store unit to output, for example, a color weighting factor W_C and a texture weighting factor W_T. Murakawa further teaches that the weighing factors may be based on the chromaticness and the peak value of the spectrum image, and the edge intensity. The weighing factors may be displayed to provide the user with an option of setting these factors. Furthermore, a record pointer indicating the memory address of a memory area storing images to be compared for search is moved to the beginning of address. The similarity values indicating the degree of similarity on the objective images are sequentially obtained to check if the image is similar to the key image (Figs. 7 and 8; col. 7, line 17 to col. 8, line 10).

That is, in Murakawa, the feature values of the objective image are loaded and the similarity values are calculated from the feature values of the key image and the feature values of the objective image. As a calculation of the similarity values, for example, a color similarity value R_C and a texture similarity value R_T are separately obtained. Next, the total similarity value indicating the degree of total similarity is calculated. The total similarity is a single index obtained on the basis of a plurality of similarity values such as the color similarity value and texture similarity value, in consideration of the weighting factors (Fig. 8; col. 8, lines 27 to 55).

Specifically, in Murakawa, the similarity value with higher weighting factor contributes more to the total similarity value, whether the total similarity value is larger than a predetermined threshold value or not is checked, and when larger, it is judged that the key image and the objective image are similar. (Fig. 8; col. 8, line 63 to col. 9, line 67). When retrieval of all the objective images are completed, the processing is finished. Thus, this method eliminates the necessity for the user to set the weighting factors by trial and error and makes it possible to retrieve a desired similar image with less number of retrievals (Fig. 8; col. 3, lines 43 to 57; col. 8, line 11 to col. 9, line 67).

Tanaka discloses an image data processing apparatus for comparing images based on color feature information of the images(*see* Abstract). In Tanaka, the image data processing apparatus extracts a color feature from images and compares images based on the extracted color feature of images to determine whether the images are similar to each other. Tanaka teaches that the image database stores image data and feature information related with the image data. The input section inputs an image data from which a color feature information is extracted. The input section also designates an image data which is used as a search key according to the user's

operation. The color feature extraction controller extracts color feature information from the image inputted by the input section and registers the extracted color feature with the image data to the image database (Fig. 1; col. 3, lines 35 to lines 55).

Specifically, Tanaka teaches that the color feature extraction controller extracts the color feature information by <u>sorting colors constituting the image into a plurality of color groups based on color elements and counting a number of pixels belonging to each color group</u>. The color feature information may comprise a representative color of the color group and the number of pixels in each color group. The color elements may comprise a hue, saturation, and lightness. Next, the controller compares images based on the color feature information of the images including calculating a degree of similarity between images based on color feature information. The degree of similarity is used for comparing images (Fig. 1; col. 3, line 55 to col. 4, line 7).

Murching, on the other hand, teaches a process for extracting regions of homogenous texture by dividing the digital picture into blocks of different sizes or even overlapping blocks and generating a feature vector for each block as a function of data momentum (Fig. 1; col. 1, lines 37 to 49 and col. 2, lines 13 to 20).

Moreover, Deng PGF is being cited for its teaching of color image quantization, peer group filtering, clustering, and using Lloyd algorithm (see page 22, § 3 titled "Color Image Quantization"). Deng CIS is being cited for its teaching of color image segmentation, particularly, its teaching of j-value and spatial segmentation (see Fig. 5; pages 448-449, §§ 3-4.3). Cieplinski is cited for its teaching of having a descriptor (color histogram) for each block based on the dominant colors, *i.e.*, weight of the dominant color and ratio of the number of pixels to the total number of pixels in the block (col. 2, line 52 to col. 3, line 33). Ma is only cited for

its teaching of Garbor feature representation for textured images (pages 425-426, §§ 2 and 2.1). Nakao is cited for its teaching of assigning 1 to black pixels and 0 to white pixels (Fig. 14; col. 25, lines 58 to col. 26, line 4). Hargrave is cited for its teaching of entropy weight (col. 7, line 55 to col. 8, line 14). Finally, Prichep is cited for its teachings of using Gaussian normalization in order to improve the accuracy of subsequent statistics (col. 7, lines 45 to 48).

The Examiner contends that Murakawa suggests each feature of independent claims 1 and 2. This rejection is not supportable for at least the following reasons.

Claim 1 recites in part "by combining one or more weighted color distances and one or more weighted texture distances by considering human visual perception attributes, wherein the one or more weighted color distances and the one or more weighted texture distances are obtained by applying predetermined weighting factor to each texture distance and to each color distance." Amended claim 2 recites in part "calculating a feature distance between the query image and each data image by combining the weighted color distances and the weighted texture distances by applying a second set of differing weighing factors that reflect human visual perception attributes."

The Examiner contends that Murakawa's steps V141 and V142 are equivalent to applying predetermined weights to each individual distances and Murakawa's step 143 is equivalent to combining the distances by applying varying weighting factors that reflect human visual perception attributes (see pages 5, 6, and 8 of the Office Action). Murakawa, however, only has one set of weights and lacks teaching one set of predetermined weights and one set of varying weights.

Murakawa deals with having an image retrieval system, where the objective image is inputted into the similar-image retrieval unit V14, which comprises of weighing-factor setting unit V141, a similarity-value calculation unit V142, a total similarity-value calculation unit V143, and a comparison unit V144 (Fig. 8; col. 7, lines 17 to 34). Specifically, Murakawa teaches that in step S1402, the feature values of the specified key image are loaded and in step S1403, weighting factors for the feature values are calculated from the feature values of the key image (Fig. 8; col. 7, line 47 to col. 8, line 10). In step S1404, Murakawa teaches displaying these weighing factors for the user to manipulate, in step S1406, the feature values of the objective image are loaded, and in step S1407, the similarity values are calculated from the feature values (col. 8, lines 11 to 35). In step S1408, a total similarity value is calculated based on the individual similarity values in consideration of the weighing factors obtained in the step S1403 (Fig. 8; col. 8, lines 36 to 67).

That is, Murakawa only teaches applying weights when combining the two individual similarity values. Murakawa, however, fails to teach or suggest applying predetermined weights to the individual similarity values and combining the weighted individual similarity values. In short, in Murakawa, the individual distances are weighted only once, *i.e.*, when the two are combined. Clearly, Murakawa fails to teach or suggest applying predetermined weights to the individual similarity values and then when combining individual weights applying varying set of weights that reflect human visual perception attributes. In summary, the deficiencies of the Murakawa reference fall to the Examiner's burden to show inherent inclusion of the claim elements. Therefore, for all the above reasons, independent claims 1 and 2 are patentably distinguishable from Murakawa.

With respect to the rejections under 103, Applicant respectfully traverses these rejections in view of the following arguments. Claims 3-12, 14-19, 23-25, and 29-31 are rejected as being unpatentable over Murakawa in view of secondary references, *i.e.*, Tanaka, Murching, Deng PGF, Deng CIS, Cieplinski, Ma, Nakao, Hargrave, and Prichep. These secondary references do not compensate for the above-identified deficiencies of Murakawa. Together, the combined teachings of these references would not have (and could not have) led the artisan of ordinary skill to have achieved the subject matter of claim 2. Since claims 3-12, 14-19, 23-25, and 29-31 dependent upon claim 2, they are patentable at least by virtue of their dependency.

In addition, the Examiner alleges that the distance metric recited in claim 17 is well known (page 16 of the Office Action). If, as alleged by the Examiner, this exemplary feature is well known, Applicant respectfully requests that the Examiner provide a reference teaching this alleged well known distance metric.

Further, the Examiner rejected claim 19 as being unpatentable over Murakawa, Tanaka, Murching, and Nakao (see page 17 of the Office Action). Specifically, the Examiner alleges that one of ordinary skill in the art would have been motivated to combine Nakao with Murakawa, Tanaka, and Murching because they are from the same endeavor of feature extraction and because it would be advantageous to limit subsequent operation to only areas completely inside the region of interest (see pages 17-18 of the Office Action). Applicants respectfully disagree.

Nakao is directed to character recognition and not to image retrieval. When attempting to recognize characters different consideration come into play, *i.e.*, color does not play a big role when attempting to recognize characters. In short, one of ordinary skill in the art would not have turned to Nakao in attempting to design a image retrieval system. Moreover, the Examiner

acknowledges that the combined teachings of Murakawa, Tanaka, and Murching do not teach or suggest dividing a circumscribing rectangle into sub-rectangles and each sub-rectangle is given a value of 1 if completely inside the region (see page 17 of the Office Action). Nakao only teaches setting a 1 for a black pixel and 0 for a white pixel and fails to teach or suggest setting a value for a sub-rectangle depending on whether it is completely inside a region. In other words, Nakao only teaches 1 for black pixels, 0 for white pixels and not for sub-rectangles and not for determining whether the sub-rectangle is within a region. In short, Nakao does not cure the deficient teachings of Murakawa, Tanaka, and Murching. For at least these additional reasons, claim 19 is patentable over Murakawa, Tanaka, Murching, and Nakao, taken alone or in any conceivable combination.

Moreover, the Examiner rejected claim 25 as being unpatentable over Murakawa, Tanaka, Murching, and Hargrave (see page 18 of the Office Action). Specifically, the Examiner alleges that one of ordinary skill in the art would have been motivated to combine the references because allegedly Hargrave is from the same field of endeavor and because entropy weight values serve to indicate the relevance of the term to which it is applied (pages 19-20 of the Office Action). Applicant respectfully points out that Hargrave is not from the same field of endeavor, in that it relates to <u>machine translations</u> by using fuzzy matching (col. 3, lines 39 to 45) and <u>the entropy weights are used for n-grams</u>. One of ordinary skill in the art, confronted with a problem of image retrieval would not have turned to Hargrave that deals with machine translations. Hargrave is clearly not from the same field of endeavor. Moreover, Hargrave teaches that entropy weight value serves to indicate <u>the relevance of a particular n-gram</u> and <u>not the relevance of the term</u> to which it is applied. In the present invention as set forth in claim 25, however,

there are no n-grams. In short, one of ordinary skill in the art would not have been motivated to combine Hargrave with Murakawa, Tanaka, and Murching in the manner suggested by the Examiner. For at least this additional reason, claim 25 is patentable over the combined teachings of Murakawa, Tanaka, Murching, and Hargrave.

Finally, claims 29-31 are rejected as being unpatentable over Murakawa, Tanaka, Murching, and Prichep (see page 20 of the Office Action). Prichep, however, is clearly not from the same field of endeavor in that it relates to using discriminant analysis of EEG data to automatically evaluate the probability that an individual patient belongs to specified diagnostic categories or a subtype within a category where there are more than two categories (see *Abstract*). Clearly, a medical diagnostic system is not in the same field of endeavor as image retrieval system. Indeed, one of ordinary skill in the art would not have turned to Prichep. For at least this additional reason, claims 29-31 are patentable over Murakawa, Tanaka, Murching, and Prichep.

Allowable Subject Matter

The Examiner indicated that claims 13, 20-22, 27, 28, 32, and 33 contain allowable subject matter and would be allowable if rewritten in their independent form including all the limitations of the base claims and any intervening claims. Applicant requests that the Examiner hold the rewriting of these claims in abeyance until arguments presented with respect to independent claim 2 have been reconsidered.

In addition, Applicant submits that there is no acquiescence to the Examiner's reasons for allowance.

New Claims

New claims 34 and 35 are added to describe features of the invention more particularly and to further distinguish the invention from the prior art references.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: February 22, 2005

AMENDMENTS TO THE DRAWINGS

The attached sheet of drawings contain the following changes:

In Fig. 5, the two axes are labeled x and y.

Attachment: One Annotated Sheet